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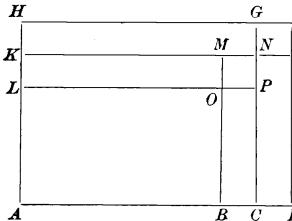
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of the generated content ABC will be $aBC + bAC + cAB$; and the moments of the generated powers $A^2, A^3, A^4, A^{\frac{1}{2}}, A^{\frac{3}{2}}, A^{\frac{1}{3}}, A^{-1}, A^{-2}, A^{-\frac{1}{2}}$, will be $2aA, 3aA^2, 4aA^3, \frac{1}{2}aA^{-\frac{1}{2}}, \frac{3}{2}aA^{\frac{1}{2}}, \frac{1}{3}aA^{-\frac{3}{2}}, -aA^{-2}, -2aA^{-3}, -\frac{1}{2}aA^{-\frac{1}{2}}$ respectively; and in general, that the moment of any power A^m , will be $\frac{n}{m}aA^{\frac{n-m}{m}}$. Also, that the moment of the

generated quantity A^2B will be $2aAB + bA^2$; the moment of the generated quantity $A^3B^4C^2$ will be $3aA^2B^4C^2 + 4bA^3B^3C^2 + 2cA^3B^4C$; and so on."

We shall now illustrate Newton's method by the notation in common use:



Let it be required to find the increment of the rectangle $ACNK$. Let $AC=x$; $CN=y$; $BC=-\frac{1}{2}dx$; $CD=+\frac{1}{2}dx$; $MO=NP=-\frac{1}{2}dy$; $NG=EF=+\frac{1}{2}dy$. Now, let xy represent the value of the rectangle when it has reached $ACNK$. First, giving to x and y the increments $+\frac{1}{2}dx$ and $+\frac{1}{2}dy$, respectively, and then the decrements $-\frac{1}{2}dx$ and $-\frac{1}{2}dy$, we shall have:

- (a). $(x + \frac{1}{2}dx)(y + \frac{1}{2}dy) = xy + \frac{1}{2}ydx + \frac{1}{2}xdy + dx dy.$
- (b). $(x - \frac{1}{2}dx)(y - \frac{1}{2}dy) = xy - \frac{1}{2}ydx - \frac{1}{2}xdy + dx dy.$

Subtract (b) from (a), and there will remain the absolute increase of the rectangle, i. e., $ydx + xdy$. In a similar manner, it can be easily shown that the increment of the volume xyz is $xy.dz + xz.dy + yz.dx$. Newton's method, therefore, is vastly superior to the others, in that it disposes of $dx dy$, $dx dz$, $dy dz$, $dx dy dz$, dx^2 , dy^2 , etc., by a mathematical demonstration that is rigorously exact. That is to say, when those higher differentials are used in connection with differentials of the first order.

AN ELECTRICAL HYGROMETER.

[Abstract.]

BY LUCIEN I. BLAKE, LAWRENCE.

An hygroscopic substance, as chloride of zinc, is made the electrolyte in a galvanic cell. Variations in the amount of moisture in the atmosphere will alter the amount of this electrolyte and consequently the internal resistance of this cell. The cell itself is conveniently made by a strip of zinc and one of copper bridged by a piece of filter paper soaked in $ZnCl_2$. By connecting the poles through a sensitive galvanometer the deflections may be used as an indication of the amount of moisture present in the air. After five hours the polarization is about 20 per cent., hence it is practically *nil* during the time of an observation. Comparisons have been made for about a week with a Regnault's hygrometer. While the deflections followed the Regnault's with regularity, as yet the law connecting the amount of moisture and the deflections of the galvanometer has not been fully established. It is believed the instrument may be employed for a simple, inexpensive, and fairly accurate method of hygrometric observations.

FACIAL EXPRESSION AND ITS PSYCHOLOGY.

BY A. H. THOMPSON, TOPEKA, KANSAS.

The human face is said to be the mirror of the soul, because it reflects not only the static intelligence and refinement of the mind, but also betrays its transient emotions and passing impulses. The face is the servant of the emotions. It mir-

rors the feelings and gives expression to the impulses. It is the visible record, the map of the heart, advertising the character of the man to all who care to read. It is the herald of the heart, proclaiming the man. It betrays the impulses which underlie his actions. The face also serves the mind when it is affected by the heart and the emotions; and as most actions and thoughts are caused by the emotions, the face is often summoned to picture forth the feelings that affect volition. It thereby reflects the mind by betraying the impulses that prompt thoughts or actions. It is, therefore, the servant of the conscious activities. It does not reflect unconscious or automatic thoughts or actions. It is the mirror of the living soul, —not of the house in which it lives nor of the machine which it moves.

As Sir Thomas Brown said long ago, "There are mystically in our faces certain characteristics which carry in them the motto of our souls."

The face is the expressional area, *par excellence*, wherein the physiognomy of the individual, as revealing his character, is most indicated. The face is, indeed, physiognomy condensed. While it is but a factor of the sum total of the physiognomy of the individual, as expressed in all parts of the body, it is the most important factor, and is far more expressive than any or all the other parts. Physiognomy is merely a division of physiology—not an occult science for the reading of character—and indicates the impress of psychic influences upon physical structures; *i.e.*, the body takes the impress of the mind and heart, and their visible appearances are observed in the outward form and peculiarities of the individual. As thus indicating character, the physiognomy of the face is the concentrated expression of the peculiarities of his mind and heart. While character is revealed in all the parts of the body and their motions—the trunk and its carriage, the limbs and their gestures, and the walk, the head and its poise, the dress and its disposal—it is in the face that it is most clearly written. Indeed, very early in the history of the race it was noticed "that the good and evil passions by their active exercise stamp their impress upon the face, and that each particular passion had its own expression. From a very early age of human thought this fact attracted philosophic consideration." (Alex. McAlister.) As the "Son of Sirach" had it, "The heart of a man changeth his countenance, whether for good or evil."

Therefore the expressional duty of the face is to symbolize character. In common with the physiognomical functions of other parts of the body, the face assists in symbolizing the man, and depicts him as he is, in unmistakable signs. It is superior to them also in that it is the especial messenger of the emotions, and exaggerates the manifestations of character which the less effective parts merely indicate. The other parts bear a passive share in this symbolical work, but the face is active and aggressive. The symbols are not occult and secret and known only to the initiated, but are so open and plain that even a child may read and know plainly and simply the heart of the wearer of them. Of course experience and long and close observation of men increases the skill of and faculty in reading faces aright; but yet the power is instinctive in all men for it is born with them, and is exercised unconsciously from the cradle. "I am much of Lavater's opinion," says Cowper, "and am persuaded that faces are as legible as books, and are less likely to deceive us; in fact, I cannot recollect that my skill in physiognomy ever deceived me."

The accomplishment of reading faces by the outward natural signs and symbols of character is valuable in proportion as men have dealings and intercourse with each other; and in this day of mutual and extensive dependence the faculty is of inestimable worth to all men. As a writer well says: "Knowledge of the world includes the ability to tell or guess well, at sight, what a man is, or will do, or feel, in certain events. It comprehends a swift and intuitive perception of character as displayed in form, and such a perception as penetrates far beneath the surface of

emotional expression right into the foundation forms in which are the true symbols of the mind's nature." Or as Henry Fielding puts it, "I conceive the passions of men do commonly imprint sufficient marks on the countenance, and it is owing chiefly to the want of skill in the observer that physiognomy is of so little credit in the world." Noble old Bacon hath it that "the lineaments of the body do disclose the disposition and mind in general; but the motions of the countenance do not only so, but do further disclose the present humor and state of the mind and will. Although physiognomy and related sciences have of late years been used to be coupled with superstitious and fantastical arts, yet, being purged and restored to their true state, have a solid ground in nature and are profitable in life." But Lavater, charlatan that he is, in spite of his sentimental assumption of character and mind-reading power and his fantastic use of physiognomy, has much to say that is of value and interest, when his voluminous observations can be culled of his intuitive and self-evolved philosophy. He says, truthfully, (*Physiognomy*, 1793): "He is a weak and simple person who affirms that all faces affect him alike. . . . The eye, the nose, the mouth, the forehead—whether considered in a state of rest or during their innumerable varieties of action—whatever is understood by physiognomy, are the most expressive, the most convincing picture of interior sensations, passions, will, etc., in fine, of all those properties which exalt the moral nature above animal life. . . . Physiognomy is the science or knowledge of the correspondence between the external and internal man—the visible superficies and invisible contents. It is, properly so called, the observation of character at rest, which is displayed in the form and appearance of the movable parts while at rest. Character impassioned is manifested by the movable parts in motion." Many grains of truth and reason may be gathered from the pseudo-scientist, Lavater's, ramblings, but the gathering requires the winnowing out of a deal of chaff. In replying to scoffers, he well says: "The human countenance, that mirror of Divinity, that noblest of the works of the Creator—shall not motive and action, shall not correspondence between the interior and the exterior, the visible and invisible, the cause and effect, be there apparent?" Or again: "All men (this is indisputable), absolutely all men, estimate all things whatever by their physiognomy, their exterior superficies. By observing these on every occasion they draw their conclusions concerning their internal properties." Truly no one could dispute such a self-evident truth; but then he goes on and loads it down with such a burden of fantasy about character-reading that, while he disclaims any such intention, he has done little to redeem physiognomy from its degrading association with chiromancy and the occult arts, and it remained what it had been for centuries—the synonym of quackery and imposture. Yet he wrote a great, if curious, work. It marked an era in the study of physiognomy, although his science is a burlesque and his philosophy a travesty. It has been said that "Lavater was guided in his estimates of character by a rapid intuition, by a kind of restricted perception, and his assurance of truth was but unintelligent conviction." His great work was too popular in style, and too unsystematic, to be of any great value to the world.

But, "to symbolize is not, indeed, the chief object of the construction of the bodily parts, nor of the features of the face. The general law of symbolic construction is that form is made to be significant without interfering with the fitness of parts for other purposes than those of symbolizing," as a writer says. In other words, the physiognomical function does not interfere with the physiological function, nor *vice versa*. "The features in which the symbols are most evident, have the fitness for breathing, speech, etc., or their primary design. But their being perfect for these purposes does not hinder their having also a symbolical meaning."

"The body and the mind, the sign and the thing signified do not correspond as

effect to cause, but as things derived from a common origin and planned with one design. . . . The Divine mind has made them both according to one idea, and there is perfect congruity between them, and in the visible the invisible is revealed. In this view the study of symbols in the human form is but a branch of that which seeks them in the whole world." The argument of design is, in our day, superseded by the principle of evolution; the mind and body are developed together and both partake, of course, of the hereditary influences which control the growth of both, and both are impressed also by the after experiences of the individual. "Men have in all ages been accustomed to symbolize their own ideas, and this is evidence of their consciousness that internal things may be aptly expressed in corporeal form, and they are affected by them as by the ideas which they incorporate. This establishes the antecedent probability of the doctrine of symbols in the human form.

"Thus, certain peculiarities of form and feature are so characteristic of the man, that we naturally call them masculine, while others are essentially feminine, because they are characteristic of woman. These signs symbolize the sexes. Feminine features in a man and masculine features in a woman always reveal a corresponding misplaced cast of mind. So it is with child-like features in adults. So the evident coincidence between national and mental characteristics presents us with a large series of symbolic forms admitting of rational interpretation." But the weakness of the whole system of physiognomical character-reading is in the inherent weakness of this same law of coincidence. A given expression and a given mental or emotional characteristic occurring together in a hundred cases might, if the observations were extended no further, be taken as revealing a relationship between them, and that they always occurred together. But if another hundred cases were observed, many exceptions to the rule would be found where the expression and the mental peculiarity occurred independently. Of course there are exceptions to all rules; but in physiognomy the exceptions are so numerous that it is unsafe, with all the experience of more than two thousand years, from Aristotle to Darwin, to attempt to formulate a law for character-reading.

"Another series of symbols are those of the likeness of the normal and constant features in some persons to those expressions which more commonly disclose the transient or habitual states of the mind. These transient expressions, as symbols universally acknowledged, by which the natural pantomime of life is carried on, indicate in their ordinary occurrence only the present or passing state of mind. They tell what the mind now is, but, by frequent repetition, the marks of any of them may become fixed in the features, and soon they indicate the acquired character—they reveal the habitual nature of the mind, and tell what the mind has become. But both the transient and habitual expressions must be distinguished from those symbols which, though like them and interpreted by them, are inborn, or which, as the features are gradually fixed, become more marked, even though the disposition which they commonly symbolize may be resisted, or, by education, quite suppressed; for these natural, permanent expressions are among the symbols which tell, not what the mind is or has become, but what it was or might have been. That the natural propensities, as indicated by the appearance, are often subdued, is a matter of common remark. 'I have seen,' says Addison, 'many an amiable piece of deformity, and have observed a certain cheerfulness in as bad a system of features as was ever clapped together, which has appeared more lovely than all the blooming charms of insolent beauty.'" It is the incongruities of physiognomy that militate against the pretenses of the character-reading theories; fine physical form of features by no means indicates a beautiful soul behind the face, and no more does mere physical deformity mean that the soul is deformed—although we would all prefer that a beautiful soul should look out of a beautiful face. It is too often this desire

to associate the two that leads to theorizing, upon the assumption that nature associates desirable internal characteristics with attractive features, and disagreeable dispositions with repulsive features; but, in reality, she does not do this at all, but gets them sadly mixed. In fact, it is impossible to bring character-reading down to a rational basis, and to classify expressions into a system. Lavater and his followers tried it, and failed. We can only judge of faces by our inherited instincts and intuitions. We can do little more than the child does—judge by the conscious effect expressions produce upon our feelings. In fact, expression is a thing of the feelings, and of the emotions. It is not of the mind, and therefore defies analysis, as do all phenomena of the feelings.

It is a matter of common observation that education, refined associations, and intellectual occupations, by elevating the mind, refine and spiritualize the face, in token of the refinement of the soul behind it. Thus the faces of persons with truly great minds—authors, artists, orators, statesmen, etc.—betray their greatness, and are an attractive study to persons of sympathetic intelligence. The faces, for instance, of Cardinal Newman, Savanarola, Gladstone, Lincoln, are beautiful even in their homeliness, because of the great souls which have stamped them with the seal of superiority. In ordinary life we recognize a “good face” as betokening a good heart, and are instinctively drawn towards it. When such a one possesses a high intelligence also, we look for a perfect man—one to trust and obey; for of such are they that lead men and move the world.

Of course there are exceptions to this rule. Refined faces are sometimes found among people of low intelligence and brutal tastes; but these are only erratic, and only indicate minds which by proper development amid favorable environments might have grown to something superior. They merely mean native superiority, latent and undeveloped. Or again, persons of education and refined associations sometimes have brutal faces; but these are only examples of misplaced education, the natural instincts not being of the high order that give the best results by training. But these are only exceptions to the general rule that a refined and spiritual face indicates either inherited or cultivated superiority, or both together.

It has been observed that faces grow in refinement as the mind develops. This is especially noticeable in schools and colleges, when the coarse, animal features of the child unfold and bloom into refinement and beauty as the education progresses. The face refines as the mind develops. And the person devoted to an intellectual or spiritual life reflects that life in his face, which grows more and more refined and beautiful as he pursues his elevating occupation and develops therein. The best examples of this development are found, of course, in those in whom the natural bent of the mind is favorable to such influences. Where it is unfavorable, the best of influences make but little impression.

Heredity has much to do, of course, with facial beauty and refinement. Generations of cultured associations and education will naturally produce faces of innate refinement and spirituality. If the course of such a life in a family is uninterrupted, it will lead more and more to beauty and refinement of features. But it is, unfortunately, rarely uninterrupted. There is degeneration in nearly every generation, either through crossing with coarser stock, or lack of education or moral influences or cultured associations, or the demoralizing effects of dissipation or low pursuits. So it comes about that coarse and refined faces occur side by side in the best of families, and often, also, in the worst. A refined face may appear in a coarse family, or a coarse face in a cultured family, through the workings of the law of atavism. That law will account for a low and brutal mind, a “black sheep,” in the best of families, or of a refined individual in an uneducated and coarse family—the reäp-

pearance of former conditions. Such reappearances are due entirely to hereditary causes, and are in no case sporadic or accidental. Nature always works by law.

When we reflect that it is but a very few generations since our ancestors were savages, and that the length of that savage life was incalculably long, as compared with the brief span covered by the civilized and historical era—during which countless impressions, physical and mental, were stored up and made permanent and transmissible—it is small wonder that low and animal instincts and tastes are so paramount in our lives. It is these impulses, inherited from that long and dreary savage life, that we have to combat continually as we strive after a higher life. It was during that period that the mind of man was evolved and differentiated from the mental organism of the mere brute. With the evolution of the mind, the face was developed and humanized, and, as it receded from the animal face and approached a higher form, it became the index of the human soul. The face of the lowest savage man is little above that of animals in expression (except of superior mental power), because the higher mental qualities and emotions are yet dormant. As he emerges from savagery into barbarism, he begins to feel somewhat for others, acknowledges that others have some rights, and from this stage the emotions are developed, and his subsequent refinement and elevation are assured. The mind was more or less fully grown in savagery, and what it has advanced since then is merely by means of the artificial culture which has been superadded. So it is that the face has undergone but little physical change in historic ages, but has changed only in refinement, by reason of the cultivation of the mind. If the child of any of the civilized races of men should be reared in savagery, without education, he would be but a savage; showing how near we yet are to our savage ancestry, and how easy is reversion.

With the birth of the emotions a great step forward was taken in the development of the face, for the emotions have much to do with facial beauty. A high intellectuality alone will not make a refined and beautiful face. Such a mind must be wedded to a warm heart to sanctify its mere strength. The noble impulses of great minds come from good hearts that prompt them to say and do great things for mankind. Lincoln's great deeds and sayings were due as much to goodness of heart, as to natural strength of mind. Napoleon was great intellectually in one direction, and by the brutal strength of his mind plowed his way through men and left death and misery in his path. He was so heartless and selfish that the world despises him as a man, and scarcely cares to admire his unquestioned genius. With the greatest of the world, as well as in ordinary life, it is the man who is kindest and best hearted, that has the most influence with his fellows. Good emotions are, in fact, the main factors of spiritual beauty; for the growth of the elevating emotions has a refining effect upon the face, and measurably atones for the absence of education or mental strength, which sometimes weakens a face. Thus the religious feelings have a perceptible effect on the face. Being the ally and messenger of the heart, and the emotions, it is but natural that the face should partake of the religious emotions and reflect them. Pure religion has a beautifying effect upon the face, and spiritualizes it. A highly spiritual life by the devotees of any creed, in which all selfishness and sordid things are excluded and forgotten, and the passions, which so distort the features, are completely restrained, has this ennobling effect upon the face, richly. This is always noted in the priests and disciples of any creed, whose faces have a peaceful and pure expression which nothing else can give. It argues that the passions and selfish feelings have the most degrading and disturbing influence upon facial expression, and that unselfishness and the contemplation of lofty themes have the most elevating and refining effect. But as the animal selfishness, which we have inherited from our savage ancestors, is yet the mainspring

of most of our actions, it is little wonder that there are few faces that are beautified by refined emotions and reflected unselfishness.

The struggle for existence in our selfish commercial life is quite as fierce as in the days of our ancestors.

The fittest in physical prowess survived then, and the fittest in commercial shrewdness survive now. There is a difference, however, that the unfit are cared for to some extent by the more fortunate in our day, especially when intellectually or spiritually superior. But the financial conflict and the grinding care this conflict brings upon all classes, weighs down the minds of men and furrows the face with lines. The daily anxiety about the means of living does more to destroy facial beauty than grief or suffering. It springs from and fosters selfishness and misanthropy, and crowds out higher thoughts and better emotions. It is this care and anxiety that destroys all traces of beauty, either natural or acquired, in ordinary faces. Surely civilization has done little for the struggling masses;—better the communism of barbarism than this soul-destroying conflict and anxiety!

And yet there some beautiful and spiritual faces to-day—the reflection of lofty minds and souls on which the sordid cares and anxieties and selfishness of life seem to have had little effect. They are such as have been saved by circumstances from toil and anxiety and are thereby enabled to give their thoughts to lofty themes, or those who by temperament are oblivious to care and carry the burdens of life lightly, or of those who by strength of mind ignore the petty things of life and live in a world of their own; or, more rarely, a face is illuminated by a soul lit by divine fires, and tells of a spirit not of our poor, common humanity. But the faces worth looking at and analyzing occur as rare oases in the desert of mediocrity around us, and serve but to redeem the mass from total condemnation.

Much depends upon contour, for beauty of the face. Youth is the season of freshness of beauty, as the face is then full and well rounded. This beauty of contour is produced by adipose tissue, and as age progresses this disappears, the features shrink and lose their expression, the muscles become less mobile, the skin loses its youthful color and texture, and, as the years toll off, the face assumes more and more the shape of the bony framework beneath, betraying approaching dissolution. Then, again, the experience of the years leaves its marks. The face in age may be serene and placid, or plowed with the furrows of suffering, as the life may have been happy or otherwise. Disease may also cause the face to shrink prematurely, and reduce the contour by emaciation. This, however, is usually corrected on the restoration of health by the redeposit of fat, except in the case of chronic disease and insufficient nourishment of the tissues. Contour is a principal element of beauty, in a mechanical and artistic sense, and, other things being equal, the plump face is the most agreeable and attractive. A certain amount of fullness, or tissue body, is necessary for the proper support of expression; for shriveled features cannot be expressive and active in conveying the workings of the mind.

Beauty everywhere is for enjoyment. Nature created beauty to excite pleasurable emotions. It never ministers to misery or pain. So, indeed, a beautiful face is created to be admired and enjoyed. The first thing that strikes us favorably in a face is exactness of proportion, and then harmony of the features, whatever the type. These give pleasure to our artistic sense, be it crude or cultivated; for the artistic sense is innate in all men. We enjoy a beautiful face, be it young or old, man or woman, as other beauties in nature or art, with an additional pleasure from the consciousness of it being living beauty, and that it is animated by a soul behind it whose beauty it reflects. So in the beautiful face of a child: it is the innocence and joy and freedom from care, that the face reflects, that attract us, while we admire the mere form and contour and color. So, also, with the face made beautiful

by intelligence and spirituality: we enjoy the contemplation of it for what it represents, and it lifts us above our sordid selves. The ethical effect of this spiritualized beauty in man or woman has a powerful influence for good, and it is felt by all men more or less consciously. A good face does good by its mere presence among men, and the influence of such a person cannot be estimated. But facial beauty is so varied, and standards vary so much, that, taking all classes and tastes, perhaps there may, after all, be very few healthy faces that are not attractive and more or less beautiful in some eyes—dull and commonplace as the majority of them appear.

ON THE OCCURRENCE OF MAMMOTH REMAINS IN FRANKLIN COUNTY, KANSAS.

BY O. C. CHARLTON, OTTAWA.

Through Franklin county from west to east runs the Marais des Cygnes river, which is the upper course of the Osage river. The mammoth remains which I first mention were obtained from the N.E. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of sec. 17, town 17 S., range 21 E.

Nineteen years ago De Witt C. Estes, who then owned the land, found at the base of the low bluff skirting the river on the north, a part of a tusk and a large bone. The piece of tusk was 18 inches long, and apparently composed of ivory, which was easily separated into thin, concentric scales. In 1880 W. P. Estes found, washed out in the river-bed at the same place, a vertebra having a spinous process nearly 18 inches long. Other loose parts of large bones have been found in the river-bed below this point, near Rantoul.

In May, 1889, a part of a jaw and one tooth were found. The tooth weighs 9 pounds. Last November W. P. Estes found, in same bluff, a shoulder-blade over 3 feet long, which was broken in removing it, and soon thereafter mostly crumbled to fragments. The firmer articulating end, now in the museum of Ottawa University, has a maximum diameter of 11 inches.

At this bluff the river runs in a curve convex to the northeast. The bluff is composed of 12 feet of soil and brittle clay, under which is 9 feet of whitish friable clay, underlaid by one foot of gravel resting on shale, which latter forms the river-bed. Just over the gravel the bones were found. Since 1860 the river has washed away perhaps 35 feet of this bank. Within fifteen years it has here transferred its channel from the west to the east side of a small island. Besides, the overlying clay is quite irregularly stratified, just where the bones were removed. Hence my conclusion that the bones of the skeleton were widely scattered.

Other mammoth remains have been found, in the city of Ottawa. About twelve years ago, when digging a well at No. 418 Main street, the workman, at a depth of 22 feet, came upon a mammoth skeleton, about 300 lbs. of which were removed. It was embedded in mixed clay and gravel. A part of one tooth, recently presented to our museum by Dr. H. B. Paramore, weighs 22 lbs. Part of another weighs 17 lbs.

It may be well to add that wood, not badly decayed, has been obtained at a depth of 22 feet, in Forest Park, and fragments of bones have been taken out of the river bank above Ottawa, 18 feet below the surface.